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agree that there is a strong charm in that delicacy of conversation that proceeds from a fine discernment, but such a charm must be only sometimes tasted, like luxuries which ought not to compose our constant food, and which if not prepared by a judicious hand are much more disgusting than the plainest food. We are naturally disgusted at every instance of affectation, and those who act simply according to their nature and education are sure to please.

Miss A. I believe you are right, for I have often been uneasy when Mr. J. was going out of his depth in wisdom, or attempting to fly through the delightful regions of sentiment. Q.

For the Belfast Monthly Magazine.

APPENDIX NO. 5. TO THE REPORT OF THE COMMITTEE FOR THE IMPROVEMENT OF ROADS, &c.

Extract of a Second Letter from Mr. Edgeworth, dated 1*st May,* 1808.

I THANK you for the report of your committee, of which, as I said in my former letter I had obtained a glimpse at Mr. Foster's. I see that Mr. Cumming has developed the bad properties of conical wheels in a manner perfectly distinct. This was done before by M. Camus, in the memoirs of the French Academy, which he afterwards republished in a book called "Forces mouvantes," in 1722 (in which book, by the by, there is an excellent *memoire* on the different modes of paving) but Mr Cumming's method of shewing the effect of conical wheels on the materials of the road, by means of what he calls *Friction-bars*, is new and extremely ingenious.

Mr. Russel's objections are completely answered in Mr. Cumming's second paper, in which, with his usual good sense, and with uncommon candour, he accedes to the truth of all Mr. Russel's facts, and to his conclusion, that he was a loser by using cylindrical wheels. Wherever cylindrical wheels are introduced upon fresh broken stones, or upon roads that are highly trunked or much sloping, the waggoner will always lose, because the waggon is employed in this instance not as a machine the best adapted for transporting loads, but as a machine for levelling or rolling roads. The pretended conical wheels are, in reality, narrow wheels, with the occasional assistance of the remainder of the broad wheel, which prevents it from sinking in between the loose stones, and act like Mr. Milton's idle wheels.

You observe that Mr. Jessop and Mr. Milton, and every body of science are of one decided opinion upon the subject; Mr. Milton has clearly stated the object, which peculiarly lies before your committee, not to encourage bad carriages upon bad roads, but first to make the roads good, and then to accommodate to them carriages the most convenient for the horses, the carrier, and the roads.

I believe that if such roads were made, the best carriages which could be then employed would be, very light four wheeled waggons, the parts of which may be much slighter, because, when the roads are good they will not be liable to injury from obstacles or jolts. The timber and iron of a waggon that carries three ton need not be half as heavy as what carries six. The weight upon these carriages should be limited, by restricting the number of horses to four, except where great pieces of timber, cables or machinery, are to be transported. The limiting the number of horses will be far preferable to the employment of weighing engines. In certain hilly counties, the commissioners of the turnpikes may permit a fifth horse.

The axle trees should be perfectly straight; the wheels should be made with spokes oblique in different directions alternately; the wheels should be six inches wide on the sole, and rounded off a little at the edges. The hind and four wheels should roll in different paths, which, upon perfectly good roads, would be no ways inconvenient. The edges of the wheels should be rounded off to permit them to quit the ground more readily, and to avoid cutting the road when any accidental circumstance raises one side of the carriage higher than the other.

Mr Bancroft has proposed to try experiments upon common roads with trucks drawn by men; so far as the force requisite to draw the carriage is concerned, this is a fairer experiment than is tried by horses; but no experiment tried by models can be so satisfactory to the common sense of mankind, as experiments tried by waggons of full size upon a real road. For this purpose, it might perhaps be adviseable to select half a mile of some great road near London that is sufficiently broad; to divide it into two parts by posts and rails, to leave one side to the ordinary mode of repair, and to make the other side perfectly flat, and of the best materials; and to render it smooth and compact by rolling it before carriages are admitted to run. At the ends of this experimental road, there should be temporary houses with bars, and no waggons or carts with any but cylindrical wheels should be permitted to pass, nor should any long coaches be admitted. During the month of January, for instance, two or more waggons of the construction already described, loaded with three ton each, drawn by four horses, should be constantly employed. The going and returning of these waggons on this road would be equal, perhaps, to the traffic on the common road; if the number of waggons here mentioned would not be equal to the traffic on the open part of the road, such a number should be employed as would make it so. At the end of this month the road should be opened to common carriages, and their effect during the ensuing month would determine the question. If the expense is objected to, by whom can the objection be made?—not by the rich, for good roads are amongst the greatest luxuries they can possibly enjoy; not by the poor, for the necessaries of life would come cheaper to market; the saving of horses is the saving of food; and no ingenuity of political œconomy in England can make it indifferent to the people, whether the land is employed to produce wheat or oats. Such a road, of such a breadth as I speak of, would cost four hundred pounds; and would, after the experiment, continue to be serviceable, so that the money would not be thrown away. The waggons and horses would be saleable commodities, and the real expense would be ultimately reduced to the support of these horses, to their wear and tear, and that of the machinery, to the hire of the drivers, and of one person to superintend the experiment: the whole of which would, I think, be covered by four hundred pounds more. I forgot the expense of the posts and the railings; they might indeed be supplied by hurdles, which are also saleable. The object then might be probably completed for a thousand pounds. If the committee were to offer a premium for the discovery of a better method of laying out a thousand pounds, I apprehend that their premium would not very soon be claimed.

In 1770, I presented to the Society of Arts, a scheme for a splinter-bar furnished with a spring and an index, so as to point out the force employed by horses. This was afterwards, in my absence, put in execution, and tried in ploughing, and was found not to succeed, because its vibratory unequal motions could not be summed up. But I know a method of determining, with the utmost exactness, the comparative ease with which any two *full grown* waggons may be drawn; but I do not chuse to communicate it; and one of my reasons for not mentioning it, is, lest it should be used in preference to the large experiment I have proposed.

Indeed, without an experiment of this sort, that should be open for a length of time to the inspection of all people, to carriers and wheelwrights, as well as to theorists and senators, the public mind will never be completely satisfied. And it is now well known to the good sense of legislators, that the public opinion should accompany, if not precede, municipal regulations.

As your committee has a recess, I take the opportunity of adding some experiments to justify the opinions I gave in my former letter; and as I have learned from long experience, and know it to be the common *sense* of mankind, that mechanical experiments made with models are satisfactory, not only in proportion to their niceness and accuracy, but also in proportion to the degree in which they approach to the reality of what they are intended to represent, I hope that you will not think the following experiments superfluous. They were tried with great care, and without any wish to support any particular theory or opinion.

Experiments on Cylindrical and Conical Wheels.

Having on a former occasion (vol. 2, Trans. of R. I. Academy, 1788) tried experiments on carriages in a manner similar to that which Mr. Cumming has employed, namely, by measuring the vis inertiæ remaining in a carriage after a given force had been applied to it, and after it had overcome a given resistance; I had reason to think, that doubts might occur as to the conclusions formed from such experiments, and I therefore preferred the direct application of weight as the measure of resistance.

At the same time, I observed, that all the experiments tried by Camus, and those that I had seen in public lectures, and particularly in a set of experiments tried before the society for the encouragement of arts and manufactures, the times of the descents of the weights employed were not taken into consideration. So that if it were required to ascertain which was superior of two models of carriages, to be drawn at the rate of ten miles an hour upon a table 16 feet long, it would be found that no weight that could be applied would draw either of them at that rate; because the weight, even without any incumbrance, could descend only sixteen feet in a second, and not so much if it were counterbalanced by the smallest weight or resistance. And seeing that a similar consideration should be attended to, where velocity was made the standard of comparison, I constructed an apparatus in which the velocity was regulated by a vane impinging against the air, so that after a few turns of a circulating axis, the motion of the descending weight acquired no fresh velocity. By these means, when experiments were to be tried upon the resistance afforded to any body, the motion could be measured directly by the weight required to continue the velocity of the body in question uniformly the same, notwithstanding the resistance to which it was exposed.

I have now applied such an apparatus, to determine the resistance occasioned upon given roads by the different construction of wheels.

The descending weight was made to move uniformly by a vane striking against the air. It required a weight of four pounds to give this vane a velocity that would permit the scale that held the weights to descend at the rate of thirty feet in ten seconds, which is nearly the rate at which a common waggon travels. The road on which the carriages moved, was made to represent as nearly as might be a common road, the parts of which should be in proportion to the size of the wheels of the model. The carriage was double the size of that used by Mr. Cumming. Wheels 8½ inches diameter, four inches in breadth, and 10⅝ asunder; the axle-trees were turned in a lathe, and were fitted in brass boxes. The arms of the axle-trees quite straight, and nearly of the same diameter at the shoulder and at the linch-pin..

The weight of the carriage and the load together was sixty pound, double the weight employed by Mr. Cumming. The rims of the conical wheels were made to deviate from cylinders in the same proportion as those mentioned by Mr. Cumming, so as to preserve an analogy between his experiments and mine.